The Chemical Age

Weekly Journal Devoted to Industrial and Engineering Chemistry

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Safety First

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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Chemical Engineering in the Gas Industry

IT was demonstrated recently in these columns that chemical engineering permeated most branches of industry—in many branches to the extent of 100 per cent. The gas industry is among the true chemical industries in which chemical engineering may be said to occupy something near 100 per cent. on the manufacturing side; on the distribution side it could be argued that the flow of gas in pipes is a chemical engineering problem; and in fact, within the gas industry, it is only in the utilisation of gas that chemical engineering plays an insignificant part. Striking recognition of this was forthcoming at the annual meeting of the Institution of Gas Engineers, when several speakers agreed that gas engineering was a branch of chemical engineering and that one of the most important immediate problems before the gas industry was to increase materially the number of chemical engineers employed on gas works.

Mr. A. G. Grant, in his paper on "The Design and Performance of Gas-Works Plant," has come to the conclusion that improvement in such plant has not kept pace with the many and great advances in methods and processes. There is, however, a ready explanation of this anomaly. The manufacture and purification of gas, together with the working-up of by-products, are essentially chemical processes, and chemistry existed as a science at the inception of the industry; the chemist therefore early turned his attention to gas manufacture and there has been an ever-increasing application of chemical investigation and control in gas works practice. The design of the plant in which these processes are carried out is, on the other hand, a matter for the chemical engineer, who is concerned with the correlation of engineering and process requirements. Chemical engineering, as an analytical science, is of relatively recent growth and probably it is this fact which explains the long history of empirical methods in the design of gas works plant. The essential difficulty has been the empirical nature of gas engineering. Reference to old textbooks and handbooks of the industry, even those published during the last 20 years or so, discloses frequent references to "rules" for the design of plant based on the practical experience of well-known gas engineers, such as Newbiggin or Livesey. There was no attempt at scientific design and these

On Other Pages

rules were to the effect that there should be a certain number of square feet of condensing surface per ton of coal carbonised or, in later versions, per 1000 cu. ft. of gas made per hour; a certain volume of iron oxide per 1000 cu. ft. of gas was specified, and so forth. This empirical method persisted up to 25 years ago. Such methods were practicable and perhaps justifiable when processes were simple and uniform, and in the absence of the data and the understanding which are the basis of scientific methods. They became unsound as soon as gas manufacture became complex and particularly when the steamed vertical retort introduced new types and yields of gas and by-products. Empirical corrections of the older empirical rules to meet wide variations in duty and conditions naturally failed to produce efficient plant, and there was in consequence every incentive to an entirely new and more informed attitude to design.

As has been shown in Mr. Grant's paper, there has been a complete change in the attitude of designers towards these fundamental problems, and where a complete calculation is impossible, theory is used to the fullest extent in order to reduce a problem to its fundamentals. Theoretical analysis of gas condensers, for example, shows that the heat-transfer duty of a condenser depends on gas throughput, temperature, and degree of saturation, and that it can be calculated from known theory and data; that the heat-transfer rate from gas to cooling water depends not only on gas temperature and saturation and on temperature gradient between gas and water, but also on the dimensions and arrangement of the tube surfaces and on gas and water velocities; and that water consumption is determined not only by temperature differences, but also by the heat transfer properties of the tube surface. To quote Mr. Grant's words: "Throughout the whole range of gas-works plant the scientific attitude to design is necessary—in the design of retorts, producers, and recuperators; of offtakes and gas mains; of liquor-separating and flushing systems; of condensers, tar-fog extractors, scrubbers, and purifiers; of by-product plant and its ancillaries. Indeed, a gas works provides as wide a variety of chemical engineering design problems as any branch of chemical industry. In every case, correct design can result only from full theoretical analysis, the informed use of known data, and the critical determination of experimental values, which should be of basic type and of as nearly universal application as possible. The final addition of a determinate safety margin is then a matter of experience, but its purpose is to cover the unexpected and not those known factors for which proper allowance ought to have been made."

Among the major difficulties of the contractor in the gas industry is that of disclosure to his competitors. The manufacturing and distribution sides of the industry are non-competitive and, in Mr. Grant's words, "carry out large-scale chemical processes in perhaps a wider range and variety of chemical plant than exist in any other chemical field. . . . The gas engineer or chemist places the results of his work freely at the disposal of the industry and to this there is no deterrent, as gas undertakings do not compete among themselves. The contractor, on the other hand, must compete, often in an unrestricted field, and is reluctant to publish the technical information which is a large part of his stock-in-trade. As a result there is available a vast body of information on gas-works chemistry and processes, but all too little on the design and fundamentals of the chemical plant in which the processes are carried out." The essential difficulty here is that while up-to-date manufacturers will make their own calculations and accept their own conclusions, there persists an extensive body of plant manufacturers of the older school who employ empirical methods based on experience. Experience may mean their own experience or the experience of others, and if the up-to-date manufacturers publish their information it may be misused by the older school to the detriment of those who have had the forethought to plan ahead.

This is the view expressed by Mr. Grant and by others on the contracting side of the gas industry. We are of the opinion that the solution is to bring the rule-of-thumb contractor up to the standard of the scientific contractor. This can best be done either by the contractors through their own trade associations or by gas engineers who will refuse to pass a design and accept a tender until

they have been satisfied that the calculations on which it is based are sound. This, of course, presupposes that gas engineers are capable of functioning as chemical engineers, a condition which is very far from being universally fulfilled.

An important point brought out in the debate on this paper is that the gas engineer is prepared to place at the disposal of the contractor full information as to the results and experience of operating his plant. It was stated that any contractor who did not give full service to the purchaser after installation was failing in his duty to the industry. Through this system it is possible for the contractor to make changes in design and to observe closely how these changes in design affect performance. There is a great gulf fixed between the chemical industry and the gas industry in this respect. It is an old and recurring complaint of chemical plant manufacturers that they are not able to observe the operation of their plant in practice, and that once a plant is installed it is commonly never seen by the contractor again.

It is evident from Mr. Grant's paper and from the ensuing discussion that the gas industry now recognises that it is a chemical industry and that the construction of plant is founded on the same basic principles of chemical engineering. There is thus every reason why the chemical plant manufacturer and the gas plant manufacturer should work in close collaboration through their trade associations. Many of them, indeed, belong to both associations and in our opinion all of them should. There is every likelihood that the work of the Gas Research Board will result in a greater concentration in chemical processing of coal in the gas industry and that the rôle of chemical engineering will become of ever-increasing importance within that industry. The difficulty of recognising gas engineering as a branch of chemical engineering lies in the two facts that gas engineering, even though only in a form largely empirical, was known fully 100 years before chemical engineering as such was consciously pursued, and secondly, that the gas industry is a great unit carrying out a particular process or a group of processes on a larger scale than any similar unit in the chemical industry. That fact prevents the merging of the Institution of Chemical Engineers and the Chartered Institution of Gas Engineers into one combined organisation. It also prevents the merging of the Society of British Gas Industries and the British Chemical Plant Manufacturers' Association into one united trade organisation. It may be that in the course of time these restrictive influences will be removed.

NOTES AND COMMENTS

Coal Research Deputation

COAL research is assuming great prominence these days. No sooner have we laid down one paper reporting Mr. J. G. Bennett's speech in which he said that in the next 150 years we should be hearing a great deal more about the application of science to coal, than we pick up another which tells us that a deputation of the Parliamentary and Scientific Committee has called on the Lord President of the Council to urge the case for the more scientific use of our coal resources. Sir John Anderson, in company with the Prime Minister's scientific adviser, the secretary of the D.S.I.R., and the chairman of the Fuel Research Board, sat one side of the table while from the other the Parliamentary Committee's spokesmen delivered their views, supported by representatives of the B.C.U.R.A., the National Association of Colliery Managers, and the Gas Research Board. The deputation is described as coming away "extremely pleased with its reception and convinced that the Government is thinking on the same lines as the committee with regard to the fundamental importance of scientific research to the future of the industry." Of more material significance, perhaps, is the assurance given to the committee that, where a good case can be made for any specific project, it could look forward with confidence to action being taken. Incidentally, later this month, the Government will be reporting progress in this field

when Lord Samuel's motion on coal utilisation research comes before the House of Lords.

New Conceptions of Coal

MEANTIME the scientists themselves have held a conference at the Royal Institution which will doubtless have the effect of stimulating one particular line of coal research. We refer to the meeting, organised by the B.C.U.R.A., and dealing with the "Ultra-Fine Structure of Coals and Cokes." On paper its title suggests ultra-fine specialisation and research of restricted interest, but, in fact, the papers delivered at the Royal Institution covered such diverse subjects as palæobotany, petrology, optical and magnetic phenomena, crystallography, colloid science, and physical chemistry, as well as physics and organic chemistry. As Mr. Bennett said in his opening address, the justification for the conference was to be found in the growing dissatisfaction of fuel technologists with existing methods of studying coal and of assessing its suitability for different purposes, a dissatisfaction that has been accentuated by the war-time shortage of coal and the consequent necessity of ensuring that every lump of coal shall be allocated and used to the best advantage. As the conference progressed, coal seemed to take on a different character: and we came away thinking in terms of "micelles" and "crystallites" instead of lumps. It is said that in American meat-canning factories only the squeal of the pig is wasted; the coal-physicists are even more economical, for they are using the shine of the coal—its "reflectance"—as an aid to classification, since it varies with the chemical composition of the coal sample. The new conceptions will undoubtedly form the basis of new commercial practices.

The Future of Fuel

UNDERLINING the vital nature of all these developments comes the recent speech of Mr. Harold Ickes, who is America's Petroleum Administrator and Solid Fuels Co-ordinator for War. He obliterates at one blow the idea that coal and petrol are alternative and therefore competitive fuels. At present there may be substitution and competition, but taking the long view we see that petrol is likely to vanish from the earth unless we come to rely on coal as our source of petrol! At the present rate of progress a world famine of petrol is probable within a relatively short period. During recent years the addition to the American petrol reserves has been at a rate of only one-third of annual consumption. Moreover, as Mr. Ickes stressed, total reserves were only fourteen times that of the total output for 1942. Yet the ratio of annual output to coal reserves was 1/3830, so that coal as a source of power will outlive petrol by many years. If the American petroleum interests can afford to spend £50,000,000 in twenty years on research and development, how much more must be spent on coal research if the world's internal combustion engines are to be kept running? The pre-treatment of coal, the development of gas producers and gas turbines, and the utilisation of coal as a raw material of the chemical industry also offer scope for research in which the factor limiting progress is likely to be the supply of research personnel.

Chinese Drugs

CHINA, like India, is faced with a serious shortage of drugs, the supply of anti-malarials like quinine, atebrin, and plasmoquine being particularly inadequate. Before the war in Shanghai there was a plant, belonging to the New Asiatic Company, that made aspirin, neosalvarsan, and sulphanilamide, and the fall of that city was a serious loss to the Chinese. Before the war, China had abundant supplies of the plant drug, ephedrine, used in medicine, but the Chengtu area where the *ephedra* plant grows was early the scene of fierce fighting, with the result that to-day China is short herself of the one drug of which she had an exportable surplus. The Chinese, however, have enough confidence and optimism about the course of the war, as we have already noted, to send abroad students whom they can ill spare from the investigation of immediate problems, so that they can complete their training and thus make themselves even more valuable to their country. By this means they are ensuring sound foundations for a new chemical industry, the post-war developments of which must be able to keep pace with China's general progressive policy.

Society of Chemical Industry

An American President Elected

THE 62nd annual meeting of the Society of Chemical Industry was held in London at the Royal Institution on July 9. Dr. William Cullen, who presided for the second successive year, formally proposed as his successor Mr. Wallace P. Cohoe, who would be formally installed in office in October. From time to time, he said, the society elected an American president, their last being Arthur D. Little who held office in 1928-29. It was proper that they should do so as the American section had a large and live membership and included many of the most influential American chemists, several of whom had attended annual meetings in Britain. In 1938 Mr. Cohoe was present with his wife, and took an active part in the proceedings. It might not be possible for the new president to visit this country during his term of office, but he would be visiting the Canadian section to attend the annual meeting of the Canadian Council in Montreal as the guest of honour.

The election of Mr. Cohoe was seconded by Mr. C. S. Garland, who remarked on the appropriateness of the selection, as the American section could play an important part in building up mutual confidence in the English-speaking world. Mr. Cohoe was a worthy successor to his distinguished predecessors, and it was a happy chance that Mr. Bartram as vice-president would welcome him on his visit to Canada. Mr. Garland also pointed out that Professor Earl was the first Australian vice-president of the Society. The meeting then agreed to send a cable to Mr. Cohoe congratulating him on his appointment and wishing him a successful term of office.

New Honorary Member

Dr. Cullen announced the election of Academician Alexei Bach, the Russian biochemist, as an honorary member of the society, bringing the total number of honorary members to fifteen. After reading the record of Academician

Dr. William Cullen, retiring President, now Chairman of Council of the S.C.I.

Bach's scientific achievements, Dr. Cullen handed the scroll conferring honorary membership to Mr. Zonov of the Soviet Embassy, who promised that it would be sent to Russia at the earliest opportunity, adding that the honour was a token of growing friendship between the two countries.

Result of Council Ballot

The result of the ballot for the five vacancies on the Council was next announced, the successful candidates being Messrs. H. W. Cremer, L. A. Jordan, G. King, H. V. Potter, and J. A. Reavell. Over 1000 ballot papers had been received, and Dr. Cullen, as general secretary, thanked the scrutineers for fulfilling their arduous task. He went on to say, in proposing the adoption of the annual report, that during his period of service he had had no opportunity to make any special recruiting effort, but, in fact, they wanted 3000 more members. He paid tribute to the loyalty of the Society's staff, with special reference to Miss Jones, assistant secretary. Mr. S. Robson, hon. foreign secretary, in seconding the adoption, spoke in particular of the overseas activities of the Society. These had, of course, been curtailed by the loss of connection with the Continent, but they had with them some chemists from enemy-occupied territories, and successful informal gatherings with Allied chemists had been held in London—a useful help towards laying the foundations of the edifice of peace.

Mr. Robson then paid an enthusiastic tribute to the retiring president. Dr. Cullen, he said, had been an outstanding president, notable for his warmth

of friendship and his breadth of vision. Cordial messages to him (which were read out) had been received from Montreal and from New York, the latter reinforcing Mr. Robson's own words with its frank statement "Seldom has any society had so much for which it has to thank a retiring president." Mr. Robson moved a resolution of thanks to Dr. Cullen, couched in the cordial terms of the American message, and this was passed by universal acclamation.

The Accounts

Dr. L. H. Lampitt, hon. treasurer, moving the adoption of the accounts, maintained the traditionally gloomy attitude of treasurers. It was his duty, he said, to bring them back to earth again. He contrasted unfavourably the small rise in membership (4200 to 4500) during the current war years with the corresponding figures in the last war. It was the Society's duty to meet more and more the needs of scientists in this country, and he asked members to consider whether they were really fulfilling this function, as they really possessed the most potent of potentialities for utilising chemistry in the service of mankind. Five-sixths of the subscriptions contributed went into the cost of publications—the only means they had of disseminating the knowledge of what was going on in the world of chemical industry. It was the duty of members to spread the Society's gospel. The financial position was satisfactory, but only satisfactory; he would have liked to see a larger reserve. Mr. J. S. Jackson, seconding the adoption of the accounts, softened Dr. Lampitt's remarks by pointing out that the position was really very tolerable; and he called special attention to the favourable state of the Messel Fund.

Dr. L. A. Jordan proposed a vote of thanks to the officers of the Society, who, he said, had carried out their work admirably under special difficulties. The officers—and members—were animated by the spirit of service to chemistry as a whole, not to some adjectival branch of it. Speaking of overseas developments, he referred to the first-rate work of Mr. Robson in keeping in touch with the sections abroad. Mr. Bartram, their Canadian vice-president, had done fine work with the Canadian Council which, after a shaky start, was developing most happily. The appointment of an Australian vice-president led to the anticipation of an annual general meeting in Australia in the not too distant future. A final word of thanks was due to Mr. F. P. Dunn, and the work of the Publications Committee. Dr. Thomas, seconding, spoke of the possibility of a "Pan-Chemical Association," plans for the creation of which were actually before the officers. Another important part of their work lay with the exploratory Education Sub-Committee and with their representatives on the Joint Library Committee. It was for them to see that chemical education went along the right lines, which would be a help towards increasing membership. He had nothing but praise for the enthusiasm of the group and section secretaries, most of whom had held their arduous office for many terms.

The Presidential Speech

Dr. Cullen delivered to the meeting only a small portion of his presidential address, and dealt with a few problems of mining. He said that since the cyanide process few fundamental advances had been made in mining chemistry during the last fifty years. Flotation, it was true, had come into the picture during that time, and had it not been for this process, developed by two members of the Society—Sulman and Picard—both now passed on, to-day we should have been extremely short of lead and zinc. Flotation, strange to say, was not applicable to tin, one of our few indigenous metallurgical industries, and the only advance in the flotation technique so far as tin ores were concerned lay in the elimination of mispickel and sulphides. There was no rhyme or reason about the location of minerals; we did not know, for example, why Canada had nearly all the nickel, and South Africa nearly all the diamonds, though it was known why tin could not be found in certain geological environments. To-day, we knew where to look for minerals, but most of the great discoveries had been made by pure accident or by the hard-boiled prospector. There was a large amount of science behind it all the same, and Dr. Cullen instanced the Kent coalfields which were predicted on geological grounds.

He called attention to the difference between the geothermic gradient in Britain and S. Africa; here it was 1° F. for every 55 feet of depth, and had the gradient been the same in South Africa, instead of being only 1° F. for 212 feet, the gold mines there would have been worked out quite a number of years ago. Even with the favourable geothermic gradient it had become necessary to instal refrigerating plant in the Rand, a position which might be expected in British coal mines at no distant date.

The following are a few striking points from the full address, entitled "The Post-Graduate Years," which Dr. Cullen did not have time to deliver. He referred to the early days of the fight against silicosis, describing how the local chemical and medical fraternities on the Rand became extremely vocal about silicosis. Although a great deal of nonsense was talked, a start was made; and he himself was started on a career of field research not without influence on the chemical structure of mining explosives. Dr. Cullen concluded his full address by asking what share the chemists were going to contribute to the new world. "Are we going on in the old way—playing for safety first? A policy of safety never paid dividends in politics, industry or science. In my humble opinion we cannot expect to have a live alert chemical industry in this or indeed in any other country unless there is much freer interchange of ideas and experience than at present. It is exceedingly rare to find in our own journals a contribution from a staff member of one of our big chemical companies, and as a consequence our abstracts are woefully short of British material. I trust that what I have said will not only cause no offence, but that there will be a response which the whole chemical fraternity will welcome. Let me add that the omens are already propitious."

The Medallist's Address

Dr. Cullen's last official act as president was to confer the Society's medal on Dr. Lampitt. He said that this was the only occasion on which but one name had been submitted for the award, and the Council unanimously endorsed that name. In the sphere of food chemistry Dr. Lampitt was an international figure, and deservedly so. In addition, no one had rendered greater service, in his (Dr. Cullen's) experience, to the Society. After receiving the medal and an illuminated address, and replying to Dr. Cullen's remarks, Dr. Lampitt gave the

Dr. L. H. Lampitt, S.C.I. Medallist for 1943.

medallist's lecture. In the course of a very witty and provocative speech, he dealt with the many aspects of his central theme, "Chemistry in Action." He began with a reference to food chemistry, saying that it was no exaggeration to claim that it was chemistry and allied sciences which had made possible the task of Lord Woolton. Food manufacturers had maintained during the war a standard of palatability and nutritional value from the available raw materials which would have been considered impossible before 1939. Of the chemist's contribution to post-war reconstruction, he said that chemistry would play an ever-increasing part in the life of the world community, and he could understand that some chemists felt that the body of chemists should be able to influence public affairs as much as postmen or coal-miners, and be able to talk as a whole as the medical profession is supposed to. But the tasks of the postman, miner, and doctor were specific and well-defined, whereas the chemist's was not. His job was to search for truth and knowledge to improve processes; to make a more nutritious loaf or a more palatable chocolate fudge, to find a better anæsthetic or make a purer gin, to improve surgical catgut or make a stronger sewing cotton. "But we may well ask," he said, "Who *are* chemists? Surely, we must differentiate between the qualified man and the chemical worker? We

have in the Royal Institute of Chemistry an organisation which is comparable to the B.M.A. in that it represents the qualified chemists, and can speak for them. If the non-qualified—and remember those who have not a university degree, but have practised chemistry for a certain time and have achieved a definite standard may be admitted to the Institute without examination—the laboratory assistants, the process hands, desire also to have a voice there is nothing to stop them. They already have, in the B.A.C. and the A.Sc.W., organisations which can speak for them. It may be that the governing body of the country is less well informed of the use of chemistry than of the use of coal, but I would suggest that self-advertisement will not provide the panacea. Let us remember that the Royal Society has all the potential powers to make known the scientist's works to the Government. We must not forget that almost unknown body, the Parliamentary and Scientific Committee, to which are affiliated some 34 scientific organisations, which include neither the Chemical Society nor the S.C.I. Chemistry by its advance became useful to industry; in due season chemistry will become useful to the Government, and the Government will use it."

Collaboration and Training

Dr. Lampitt made some trenchant remarks about the necessity of collaboration among chemists. Much discussion had centred, he said, around proposals which had already been considered in detail and found to be impossible of realisation. The Thorpe scheme for a "Chemistry House," for instance, broke down through the impossibility of raising sufficient funds. For the Chemical Council, industry had given £14,000 and provided £3500 yearly for current expenses. Up to the present industry had shown a very generous spirit by not trying to call the tune, but the interest of individual chemists had shown that they are not or were not prepared to back their hopes by money. What was the alternative to collaboration? A federation—a new Royal Society of Chemistry absorbing all and sundry—had been suggested, but his antipathy to the idea of losing the competitive spirit caused him to view with considerable foreboding such an all-powerful body. "But, federal council or chemical council, it is the spirit of co-operation which is required and which has been lacking. The Chemical Council has the potential capacity to deal with this matter of collaboration on a sound basis, but unless the present three chartered bodies are willing to be collaborative in the biggest sense of the term then we, as chemists, must recognise that the Chemical Council with its present impotency must be swept away and a body builded on the sure foundation of 'give and take' erected in its place." Referring to the training of chemists, Dr. Lampitt said that although lip service was given by the heads of academic and industrial laboratories to the idea that stress must be laid on the necessity of thorough training in fundamentals, yet at nearly all discussions the thought appeared apparent that at the same time the training must be *practical* and allow of specialisation, to include such "broader aspects" as book-keeping, costing, and management. By all means the chemist should be equipped to talk to his colleague, the engineer or the cost clerk, but not at the expense of his chemical training. "Are we going to sacrifice everything on the altar of immediate efficiency, which is really the altar of dividends—national, capitalistic, or even personal? Are we not thereby planning for to-day, and not thinking of to-morrow? I am afraid of the modern tendency to turn chemists into automata, with the loss of initiative and stultification of imagination. 'Specialists' are being bred at the expense of 'scientists.' "

OIL FROM FRUIT KERNELS

Production of oil from fruit kernels is being developed on a large scale in Rumania, reports *Chemische Technik*. Three thousand wagons of oil are to be produced from 40 million kg. of grape seed, 1000 wagons of pumpkin seeds will yield 270 wagons of oil, and a further 100 wagons of oil will be extracted from melon pips. Tomato seeds, containing 25-30 per cent. of oil, will contribute their quota, and the residue will be used as cattle food. Hitherto 360-400 million kg. of plum kernels have been used each year for the production of spirits, and it is now intended to use 25-40 million kg. of them for the production of some 350 wagons of oil.

Chemical Treatment of Coal

The Gas Industry's Service to Chemistry

IN the presidential address which he delivered at the 80th annual general meeting of the Institution of Gas Engineers on June 9, in the rooms of the Institution of Civil Engineers in London, Mr. E. V. Evans, the President, departed from the customary survey of changes and developments in the industry that had taken place during his year of office, and dealt instead with the position of the gas industry in the national economy. Much of his address, as was natural, was concerned with the chemical aspects of the treatment of coal during the production of gas, and the extracts which we print here cover those parts of his long and interesting address which dealt particularly with this aspect of the industry.

Coal, he said, is required to provide heat, light and power in homes, offices and factories, and as a chemical raw material in the metallurgical industries and in the chemical industry. For few of these purposes is the coal as mined really suited for use without some mechanical preparation or conversion to other forms. Coal can supply the energy needed for transport, whether by land, sea or air, but the disabilities attached to its use have led transport to rely largely upon the more convenient fuels of foreign origin.

Disadvantages as Fuel

Potential chemical energy stored as coal underground is a long way from the heat or power required for the multitudinous purposes of a highly-organised community, and between the two there lies a succession of operations. To make this store of energy available involves mining, transmission in bulk from the pit-head to centres of population, distribution of appropriate quantities to individual users, and utilisation of the energy for the purpose required. At every stage in these operations coal exhibits numerous disadvantages and inadequacies, redeemed only by the single feature that it is a concentrated store of energy in a form which can be retained for use when needed without substantial loss. As a fuel for the supply of heat, coal suffers from the presence of both ash and sulphur, which provide the problems of ash disposal and of sulphur pollution of the atmosphere. Its combustion is not readily controlled because the evolution of volatile matter requires more air in the early stages of combustion, while less air is required after the volatile matter has been expelled. If this control is not adequate, smoke will be added to sulphur as a noxious constituent of the atmosphere. The coking properties of many British coals add to the difficulty of ensuring the controlled air supply which is essential to efficient combustion. The handling of the solid fuel is an arduous and dirty operation, particularly if the scale of operation is not large enough to justify mechanical handling. In less, but still serious degree, the disadvantages of coal compared with a fluid such as petroleum are apparent in the operations of winning, bulk transmission and distribution.

The practical effect of these drawbacks is seen by the degree to which petroleum fuel oil has replaced bunker coal in the ships of this country, even though we have the coal but need to purchase the fuel oil overseas and bring it long distances to our ports. In the U.S.A., where both coal and oil are indigenous, petroleum was supplying about half the total fuel requirements of the country.

These limitations and deficiencies of coal in its raw state have led to the development of specialised branches of fuel technology aiming at providing the energy obtainable from coal in a form which lends itself better to efficient, cleanly and convenient use for specific or general purposes. It is appropriate to consider the various lines of development under the headings of the technical principles involved: (a) *Mechanical Methods*, such as ash removal, breaking and screening; (b) *Physical Conversion* which (as contrasted with the chemical processing of coal) may be defined as the liberation of its energy by combustion and the transmission of this energy either as heat or electricity; and (c) *Chemical Processing*.

Chemical Conversion

This third principle employed in fuel technology involves the conversion of the potential chemical energy of coal to potential chemical energy stored in a substance more suitable to the use for which it is required. The new substances may be solid, liquid or gaseous and may have properties differing only slightly or differing very widely from those of coal. The variety of processes employing this principle is very wide and includes such operations as carbonisation, gasification, and hydrogenation, as well as the more complex combinations of processes employed in the synthetic chemical industry. From these processes there may be derived products which find uses not only as fuel, but also as structural materials or as the raw material for further chemical operations. It is characteristic of all the products of chemical conversion that they can be handled, distributed and stored without loss (except that due to accidental

spillage or leakage) and the energy is concentrated in a small weight of material, making for low cost of storage and distribution.

Over 20 per cent. of the total coal required for use in Great Britain is subjected to chemical conversion processes before use, mainly by the coking and gas industries, each of which processes over 10 per cent. of the coal required for home use. The coking industry is primarily concerned to produce coke as a chemical reducing agent for iron ore, but it produces gas and tar also. The gas industry is primarily interested in producing and distributing fuel in gaseous form, but has given much attention to the development of coke as a smokeless solid fuel and to tar as a liquid fuel. Great Britain has great need of liquid fuels for transport and, although the coking and gas industries can produce some 110 mil. gal. of motor spirit and other light hydrocarbon liquids annually, this is a very small part of the total requirement and the demand has led to projects which have liquid fuels as their main product. The technique of chemical conversion has undergone striking improvements in efficiency since it was first introduced, but its possibilities are still very far from exhausted.

High Thermal Efficiency

Chemical conversion of coal to gaseous fuel is a process that can be carried out, theoretically, with the expenditure of a very small proportion of the total energy contained in the coal, though in practice it is necessary to expend a rather larger proportion than that theoretically required in order to obtain a reasonable speed in conversion and to avoid excessive capital charges. The actual thermal efficiencies obtained in normal working approximate to 80 per cent., though some large modern installations may approach 90 per cent. Normally, not all the potential energy is recovered in the form of gaseous fuel, a large part being obtained as potential energy in coke. Typical modern gas works practice would result in there being obtained from the 300 therms potentially available in a ton of coal:

	Potential therms	*Percentage on coal*
75 therms of gas ...	75	25
3 gal. of benzol ...	5	1.7
11 gal. of tar ...	20	6.7
10 cwt. of coke ...	140	46.6
	240	80.0

At the same time about one-third of the sulphur present in the coal is recovered in a form which can be used for the production of sulphuric acid, and part of the nitrogen present in the coal is recovered in the form of ammonia.

The proportions of gas and coke made can be varied within wide limits, and some of the gas supplied is produced by complete conversion of coal to gas. At the present stage of development there is still a very large demand for fuel in solid form and the fact that the gas industry can make coke available to the public has enabled part of this demand to be met by a smokeless fuel, capable of giving a higher efficiency in use than raw coal. Some 9 to 10 mil. tons of coke are produced annually by the gas industry alone: the coking industry, with coke as its main product, produces about 14 mil. tons, most of it for the iron and steel industry. Benzol and tar may be regarded as liquid fuels, but in actual fact their uses are far wider.

Nearly 10 per cent. of the total gas sold by the gas industry in 1938 was purchased from coke ovens. This is a development which took place almost entirely between 1921 and 1938 and has proved a valuable contribution to the national fuel economy by enabling good use to be made of gaseous fuel that is surplus to coke-oven requirements and was formerly wasted. It has enabled gas to be sold for industrial purposes on a very large scale and at a low price and is an excellent demonstration of the value of co-ordination between different branches of the fuel industry.

Viewing the gas industry as a whole it is seen to be an organisation operating a highly efficient process for the chemical conversion of coal, distributing the gaseous fuel from that coal to the great majority of premises in the country and effecting personal contact with the users of fuel whether they be large or small. The next task of the gas industry is to ensure that the service so established and maintained shall be used to such an extent that the consumer and the nation obtain the fullest value for the money and resources expended. Additional supplies of gas will be cheaper, as they will not have to bear the same overhead charges.

Progress in Chemical Conversion

It has been stated that some 20 per cent. of all the coal used in this country is subjected to chemical conversion to coke, gas or liquid fuels. An increasing desire for convenience, cleanliness, precise control and general efficiency will lead towards more and more of the coal being converted to alternative forms of fuel before delivery and use. Gaseous fuel can offer all the merits of convenience combined with economy in coal, low cost and the ability to provide for irregular demands.

Progress in the replacement of raw coal must, necessarily, be gradual and is most likely to be achieved by steady development of existing organisations. Smokeless solid fuels are likely to be required by domestic consumers for some time to come,

because custom has made solid fuels to appear necessary. For this reason much attention has been given to the preparation of coke and to the development of efficient appliances for its use. Coke, however, must be purchasable at a price not greatly in excess of that of coal if its use is to become general, and it can only be made available at such a price if the gas which is produced at the same time finds a ready market. Moreover, the preference for solid fuel is one based on custom, whereas the advantages of gaseous fuel arise from its intrinsic properties.

Sulphur Dioxide Wasted

Believing that the intrinsic properties of the fuel will eventually prove more decisive than custom, the gas industry is studying newer methods of effecting the chemical conversion of coal, aiming at the maximum production of those products, gaseous and liquid, which are likely to prove of the greatest value as fuels and chemical products in the future. To what extent these processes will be needed and at what point the coal should be converted—whether at the pit, or in the towns—remain problems for solution in the future. It does appear certain that the chemical conversion of coal holds possibilities at least as great as those already achieved by carbonisation, and that the co-ordinated development of the gas industry along with other branches of the fuel industry is necessary to the national well-being.

From the amount of coal that was burnt in the raw state in this country in 1939, there was produced one million tons of smoke from domestic chimneys and probably a further million tons from factory chimneys. From the same chimneys there went into the atmosphere more than 4 mil. tons of sulphur dioxide. Now, before the coal was burnt this smoke and the sulphur dioxide were potentially available as hydrocarbons and as sulphur. It is instructive to compare these statistics of atmospheric pollution by potentially valuable materials with the secondary products obtained by the gas and coking industries through the chemical processing of coal.

"Residuals" now Valuable

In the early days of the gas industry the secondary products—the by-products—tar and ammonia, were looked upon as unavoidable nuisances and were termed "residuals." Tar was disposed of by being burnt under retort settings and ammoniacal liquor was regarded as a waste effluent to be discarded in the least objectionable manner. Small quantities of tar were distilled for the preparation of solvents and some was used in its crude state as a paint for the protection of structures from the weather. The first distillation on an appreciable scale came with the discovery of the value of creosote as a preservative for timber, particularly railway sleepers. Real interest in coal tar as a source of organic raw material for industry was aroused by the discovery of synthetic dyestuffs between 1856 and 1872 and tar was then distilled for the recovery of benzene, toluene, naphthalene, and anthracene. With the advance of chemical knowledge further compounds of interest were identified and separated, and not for dyestuffs alone. Disinfectants, drugs, photographic developers and, later, plastics, derived their basic chemical structure from the aromatic hydrocarbons and derivatives in coal tar. But at no time has the quantity of these products recovered represented more than a small proportion of the total tar made. When the synthetic chemical industry was first taking an interest in the hydrocarbons of coal tar, the annual production of tar was less than 500,000 tons annually. By the beginning of this century it had reached 1,000,000 tons and at the outbreak of the present war production was doubled again through the adoption by the coking industry of by-product recovery ovens.

The coming of the motor car, in the early days of this century, showed the need for greatly improved methods of road surfacing and coal tar found a new use. At first the idea was no more than the provision of a binder that would not dry out in hot weather, as water does, giving a dusty surface, and would not allow the road surface to revert to mud in wet weather. Progressive increase in the volume and weight of traffic and in its powers of acceleration and braking has made the preparation of tar-bound road surfaces a matter requiring scientific understanding and control. These demands have been met and road surfacing to-day is a highly skilled branch of technology that requires binders very different in properties from the crude tar which is their origin.

Tar, Pitch and Creosote

Rather less than half the total tar produced in the country was, before the war, used for road surfacing. The remainder was distilled for the production of creosote and pitch. Creosote found useful application as a wood preservative at home and abroad, and a large quantity was supplied as a raw material for hydrogenation to motor spirit. Pitch was used for briquetting small coal into lump fuel for domestic and industrial purposes, but this is a development that has found more favour on the Continent than in this country, and about half the pitch produced was exported, mainly to France and Belgium.

In 1939 the national production of tar was accounted for approximately as follows :

Production, tons		Usage, tons	
From gas works	1,000,000	As road tar ...	750,000
From coke ovens	1,000,000	Creosote hydrogenated	210,000
		Creosote used at home ...	145,000
		Creosote exported	95,000
		Pitch used at home ...	400,000
		Pitch exported...	350,000
		Sundry uses ...	50,000
Total ...	2,000,000	Total ...	2,000,000

A product allied to tar, but mainly recovered from the gas, is crude benzol. In peace-time the chief value of benzol is as a motor fuel of high anti-knock properties, though it is also a source, in such quantities as the chemical industry may require, of benzene, toluene and xylene. In war-time its value as a source of toluene is of the greatest importance. In 1936 about 210,000 tons of crude benzol were provided by the coking industry and 110,000 tons by the gas industry, but it is known that the output has been largely increased and will be increased to the practical maximum. The probable destination of this material would in peace-time be about 90 per cent. to motor fuel and 10 per cent. to chemical industry.

Under war conditions road maintenance is not carried out to the same extent as in normal times, though the materials used and experience acquired in road construction have been applied to aerodromes. The export markets for pitch and creosote are closed for the time being and tar is now being used to replace fuel oil formerly imported and thus ease the strain on fuel supplies.

Ammonia and Sulphur Recovery

Ammonia, second in importance to tar as one of the products of coal carbonisation, found no useful application until 1875-1880 when the importance of fixed nitrogen as a plant food was recognised. Development of the ammonia-soda process and other branches of chemical industry, the demand for sal-ammoniac for Leclanché cells and the use of ammonia for refrigerating plants made heavy demands upon the supplies of by-product ammonia until after the war of 1914-18. During that war it was realised how enormous are the demands for fixed nitrogen in the manufacture of the explosives required for a major war and it was necessary to supplement the resources available from by-product ammonia by the erection of ammonia synthesis plants. Broadly, it may be said that the 260,000 tons of ammonium sulphate available annually from the carbonising industries is sufficient for the peace-time requirements of this country for nitrogenous fertilisers and chemical industry. The synthetic ammonia industry represents an indispensable war reserve. Although the advent of the latter at first made it difficult for by-product ammonia to find a market in times of peace, marketing arrangements between the two sources of supply have enabled both to contribute to peace-time needs at home and abroad.

Chemical industry, before this war, required about 350,000 tons of sulphur annually for the production of sulphuric acid. The greater part of this sulphur was imported as sulphur or pyrites, but the gas industry recovered from the gas it supplied some 100,000 tons of sulphur—95,000 tons being used for sulphuric acid manufacture and about 5,000 tons being exported.

The carbonising industries have not, as a rule, undertaken the synthesis of fine chemicals from their secondary products. Where preparation for the consumer is a simple operation and can be conducted on a large scale, this has been done, *e.g.*, in the case of sulphate of ammonia, but the production of fine chemicals is a highly-specialised industry both in manufacture and sales, and its scale of operations is so different from that of coal carbonisation that the carbonising industries have hitherto preferred to sell their products in crude or semi-refined form.

Development of Simple Intermediates

In recent years the trend of chemical industry throughout the world has been in the direction of converting raw materials to a simple chemical form and synthesising from these simple forms the products required. By so doing a better control can be exercised over the quality and variety of products. There are indications both in this country and abroad that fuel processing may follow similar lines and that instead of obtaining a tar which contains many complex bodies from which the desired chemical raw materials can be separated, there will be a tendency to produce compounds of simpler molecular structure, such as hydrogen, carbon monoxide, methane, ethylene and the lighter liquid hydrocarbons.

The possibilities of developments in the chemical conversion of coal and the utilisation of its products are so great that we may reasonably expect to attract, as indeed we shall need to do, some of the keenest brains and most courageous technicians in the country. Already we can see the very great technical advantages to be obtained by producing and handling gas at pressures of many atmospheres, and by using a range of temperatures from the highest that we now employ down to that of liquid air. We know, too, some of the possibilities of chemical synthesis from simple molecules. The practical application of these principles will not be brought about by the suppression of initiative; rather does future development require that greater scope and opportunities should be given to the younger men whose ideas are less likely to run in the traditional grooves.

Industrial Safety Gleanings

Exhaust Appliances : Industrial Fires

THE problem of how best to deal with the evolution of dust clouds, fumes, gases and vapours in industrial processes is one which is always with us. Complete enclosure of the offending process, with the enclosure placed under slightly reduced pressure, is the solution which should always be considered first. Mechanical plant creating dust is particularly suitable for such treatment, as also are many chemical processes evolving gas or vapour. Incidentally, complete or substantially complete enclosure of dust-producing machines and the like also serves the secondary purpose of keeping workers away from dangerous moving parts.

Such complete enclosure will be found possible in a considerable number of instances if thought and ingenuity are applied to the problem, but in a number of cases the nature of the process or operation renders this ideal solution inapplicable and mechanically exhausted fume cupboards or exhaust hoods must then be employed as the next best thing. An exhaust hood which cannot be made to enclose a dust or fume process should be placed with its opening as close as possible to the source of the dust or fume, since the pull of an exhaust hood falls off very rapidly (actually as the square of the distance from the hood face).

The Importance of Siting

If possible, the siting of fume cupboards or exhaust hoods at which people work should be such that workers standing in front of them are between the cupboard or hood opening and the incoming supply of clean, warmed fresh air to the workshop. It is difficult to generalise as to the air velocity necessary to capture dusts and fumes and prevent their escape from the exhaust appliance, but linear speeds between 100 and 500 feet per minute are usually sufficient to capture fumes and dusts. Vapours and gases are more easily captured than fumes, and fumes than dusts. As an example, clay dust clouds in potteries are satisfactorily captured at about 220 linear feet per minute at point of origin, while cellulose solution vapours in spraying hoods are adequately removed at about 100 linear feet per minute at the hood face. Experience is the best guide, but the only certain way to arrive at the correct speed in any particular case is to take dust counts or make vapour concentration measurements just outside the hood, with varying rate of air flow into the hood. This will enable the minimum air speed required to remove the dust or vapour to be ascertained. Smoke tests of fume cupboard and hood efficiencies are only very rough-and-ready tests, as smoke is a fume, so that smoke may be easily removed where heavier and larger dust particles would not necessarily be.

A Thousand Fires a Day

The great damage to the country's war effort now being done by fires—avoidable fires—in industrial buildings was a point urgently stressed by Sir Stafford Cripps when he addressed 5000 workers in a north-western aircraft factory recently.

"I think some of us do not realise," said the Minister, "the enormous wastage of both effort and material that arises from constant fires that are occurring in our factories at this time of the war. There are, to-day, something like 1000 fires a day occurring, not all of them in our factories or industrial units, but a great many of them are in these units, and the majority are caused by carelessness of individuals. What I want to stress is that the individual must exercise the greatest care in this matter of fires in order to conserve our energies and our material for the war effort."

Commenting on Sir Stafford's appeal, one authority on industrial production confirmed it as his experience that the great majority of fires involving factories, mills, warehouses, wharfs, and so on were, in fact, caused by thoughtless or careless actions on the part of individuals, and included a high proportion due directly or indirectly to smoking. Of the remainder, he believed, many could be prevented by the wider use of adequate fire prevention equipment, especially sprinkler installations. Government-owned factories do not insure, therefore figures for any losses due to fires in these organisations are not known, but, calculating from figures representing known losses this authority said:

"The known losses due to fires greatly exceeded, every month, the money value of 400 Spitfires, or 100 twin-engine bombers, or three destroyers, or 20 corvettes for U-boat hunting. But, high as it is," he continued, "this money cost is as nothing against the deadly loss of precious raw and processed materials in short supply, of highly specialised mechanical and laboratory equipment that may have to be replaced from abroad, of vital man-power that ought to remain actively productive, and of important buildings that have to be re-erected. A single fire hits not only one point. Cessation of output from a gutted factory in one locality may slow up the work in subsidiary factories and workshops at

half a dozen others. Let us recognise, then, that the deadliest fifth columnist among us now is—FIRE. Let us determine to scotch it. We can—*with care.*"

Standardising Accident Rates

An article in the July number of *Safety News* considers the need for standardising industrial accident rates, and reaches the conclusion that the international system, in which the number of hours lost through accidents are recorded, is preferable to a statistical system based only on reportable "three-day accidents." The international standard system of Frequency and Severity Rates was evolved many years ago by the International Labour Office. Since 1920 the system has slowly but steadily gained currency in Britain and has been adopted by hundreds of individual works, by some of the largest combines, by employers' associations *en bloc* and by Government factories. That it has not become a universal system, in use by everybody and not merely the more intelligent and far-sighted, is due to one fact and one fact only. The international system takes as its unit the "lost time" accident, *i.e.*, that which causes loss of time extending beyond the day of occurrence. Official statistics, on the other hand, deal only with "reportable" or three-day accidents. Is there any real need for this difference? If it could be abolished, it would be unnecessary for firms to keep two sets of records (except in so far as Workmen's Compensation is concerned with the three-day minimum period of absence) and rates, as opposed to mere totals of accidents, would soon be available for the whole country. There is certainly an unanswerable case for having a unified system in both official statistics and in the only form of rates at present in use.

The lost-time accident is a much better basis for a statistical system than the three-day accident. Safety officers want to prevent all accidents and not only the more serious. Whether the accident happens or not is largely under the safety officer's control; the severity of its result, when it does happen, is for the most part uncontrollable by advance planning. Ideally, the safety officer would record every accident, however slight, but, as he cannot be sure of the universal reporting of such apparent trivialities, he must make use of the nearest to his ideal while obtaining certainty of records. This is given by the lost-time accident because a worker cannot very well be away from work for a day without the fact being noticed. A recent investigation has indicated that there can be enormous differences in the ratio between number of lost-time accidents and number of three-day accidents as calculated in different works. This is yet a further reason for maintaining the use of lost-time accidents as the basis of our statistical system. It seems, in fact, that in some works the main safety problem is one of preventing a large number of comparatively short absences from work. The adoption of a "three-day accident" basis might give such works the impression that they had no serious accident problem at all.

It seems wholly desirable to keep the lost-time accident as the unit for calculating accident rates and to employ every possible means of encouraging firms to use records on the international system. The fact that the statutory records use a different basis is not as serious as might at first appear because they do not, in any case, include man-hours worked or lost and so cannot be used for estimating frequency and severity.

Carbon Tetrachloride in Industry

Its Safety Limits

An article by H. P. Quadland, of the Safety Research Institute, New York, on the health hazards presented by carbon tetrachloride is printed in the May, 1943, issue of *Rubber Age* and contains a great deal of useful information. The author says that in the period 1933 to 1940, the latest year for which figures are available, American output more than tripled, rising from 30,343,693 to 100,811,000 lb., and that the increased use of carbon tetrachloride in war industry has led to a demand for more complete information about its toxicity.

In evaluating the health aspects of any organic solvent, two entirely different effects of exposure to its vapours must be distinguished. First, all volatile industrial organic solvents produce anæsthesia, or unconsciousness, if their vapours are breathed in sufficient concentration. Secondly, in circumstances favourable to the development of injury, whether it be the physical condition of the exposed person or the severity of the exposure to the toxic material, most solvents may exert secondary effects. That is, they may disturb the functioning of, or otherwise cause damage to, one or more of the bodily organs. There is considerable confusion between these two effects. Many people jump to the conclusion that serious injury always follows acute exposure to solvent vapours. This, however, may not be true. There have been numerous cases where more or less acute exposure

to solvent vapours, including carbon tetrachloride, has caused anæsthesia without any untoward secondary effects. On the other hand, exposure to unsafe concentration of most organic solvent vapours may, under the proper circumstances, cause secondary injury without anæsthesia. Such situations may occur where adequate mechanical safeguards are not set up and exposed persons do not report early symptoms.

So far as the anæsthetic effects of carbon tetrachloride are concerned, a study of the literature gives a fairly comprehensive picture. In *Toxicology and Hygiene of Industrial Solvents*, K. B. Lehmann reports the results of his experiments on humans, as follows:

Concentration of Carbon Tetrachloride (Parts per million)	*Exposure (Minutes)*	*Effects*
3200	5	None
4800	$2\frac{1}{2}$	Slight stupor
6400	3	Oppression, heaviness, stupor
9500	$1\frac{1}{2}$	Slight fainting
12,700	1	Unconsciousness, followed by complete recovery

Dr. Paul A. Davis, who conducted his experiments in Akron, Ohio, reported no lasting ill effects from brief exposure to CCl_4 vapour concentrations ranging from 158 p.p.m. to 2382 p.p.m. In the higher exposures nausea, sleepiness, and slight vomiting occurred but, 48 hours after the exposures, examination of the subjects showed no ill-effects. To endanger life, according to Flury (*Arch. Exp. Path. W. Pharmacol.*, 1928), an exposure of 25,000 p.p.m., for a period of 30 minutes, or 50,000 p.p.m. for 5-10 minutes, is necessary.

Established Standards

Consideration must be given to the fat and oil dissolving properties of carbon tetrachloride, its boiling point of 76.75°C., and especially the density of its vapours, which are 5.3 times heavier than air, necessitating downdraught ventilation with the vapours exhausted at floor level. After an extended series of experiments to find the maximum allowable concentration of carbon tetrachloride vapours that can be tolerated in the workroom without danger, H. F. Smyth (*J. Ind. Hyg. and Tox.*, May, 1936) came to the conclusion that a safe concentration for continuous exposure is 100 p.p.m., and that this amount is safe for exposure of normal persons throughout the day, and day after day, while 1000 p.p.m. is safe up to half an hour, providing the day's average does not exceed 100 p.p.m. These figures are now generally accepted in America as industrial safety standards.

Parliamentary Topics

Monopolies and Cartels

LAST week in the House of Commons Mr. Liddall asked the President of the Board of Trade whether his attention had been drawn to the court proceedings in America, seeking to restrain certain firms under the anti-trust law from monopolistic practices; and what steps he proposed to take to safeguard consumers in this country from the operation of similar monopolistic practices.

Major Lyons asked the President of the Board of Trade whether he was prepared to appoint a committee to inquire into the effect on British export trade of cartel agreements which had been entered into between firms in this country and those in other countries.

Mr. Bellenger asked the President of the Board of Trade what steps he had taken to satisfy himself that the public interest was not prejudiced by the operations of international cartels in which British firms are concerned.

Mr. Dalton replied that his attention had been drawn to the proceedings mentioned. H.M. Ambassador at Washington had been asked to furnish particulars of the charges made. In this country a considerable safeguard for consumers was afforded by our price-control arrangements.

Mr. Bellenger then asked whether the President of the Board of Trade, after receiving the Ambassador's report, would cause an inquiry to be held in this country as to the British company, I.C.I., against whom the allegations were being made.

Mr. Dalton: I think it would be better for us first to get the facts from the Ambassador's report. But since my hon. friends have raised the matter of I.C.I., I think I should tell the House that I saw Lord McGowan and Lord Melchett yesterday and that they repeated the denial already made by Lord McGowan of the allegations against I.C.I., and in particular of the serious allegation that they had been trading with the enemy. They placed themselves entirely at the disposal of H.M. Goverment.

Mr. Bellenger: In view of that serious allegation—of trading with the enemy—does my right hon. friend not think that something more is required than a mere denial by two directors of the company?

Mr. Dalton: I think we had better wait until we get the facts.

On the following day Mr. Emery asked the Minister of Supply how many persons now in his ministry were officials of any, and of which, firms alleged to be involved in monopolistic practices now under investigation in American courts. Sir Andrew Duncan said he thought it would be misleading to publish information purporting

to associate members of the staff of the Ministry of Supply with matters which were *sub judice* in a foreign court.

Ministry Employees from I.C.I.

Mr. Driberg asked the Minister of Supply, how many present and former employees and directors of Imperial Chemical Industries were engaged in his department in an executive or advisory capacity.

Sir A. Duncan: There are 61 officers in the Ministry of Supply, holding senior posts remunerated at £600 a year or more, whose services have been made available by I.C.I. There are also a number of former employees of the company who have been engaged in the normal course of recruitment.

Man-Power and Paint Industry

Major Gates asked the Prime Minister whether he was aware that the Ministry of Labour, by calling up and directing employees of small firms of the paint and varnish industry, was in effect nullifying the agreement reached by the Ministry of Supply and the Board of Trade not to concentrate that industry; and whether he would take the necessary steps to stop the practice and to ensure that there was complete co-ordination between Government departments on questions of Government policy affecting the industry. The Prime Minister suggested that the question should be addressed to the Minister of Labour.

Titanium Control

Mr. Lees-Jones asked the Minister of Supply the name of the head of the Department controlling the metal titanium; and whether there had been any association by him or any of his staff with the British firm whose associated American company was now before the American courts in connection with alleged monopolistic practices. Sir A. Duncan replied that there were no commercial uses of titanium metal in this country, and no control had been necessary.

Non-Ferrous Metal Scrap

Mr. Loverseed asked the Minister of Supply what steps had been taken to prevent the dumping, for use after the war, of turnings and residues containing high percentages of tin and copper, by firms engaged on machining work on non-ferrous materials. Sir A. Duncan said his Ministry, being in close touch with the main consumers of non-ferrous metals, ensured when releasing virgin metals that full use was made of any scrap available. He had no reason to suppose there was any undue accumulation of scrap by machinists, but he would be glad to inquire into any specific instances.

German Chemical News

Salt Federation Formed: Plastics Standards

At the end of July all existing organisations for market control in the German salt industry are to be dissolved, and their powers vested in the German Salt Federation, which will form a special department for the sale of both rock salt and brine salt, to direct sales and distribution, fix prices, organise transport, make arrangements with other countries, engage in publicity work, support research, and help increase production.

Kali-Chemie A.G., a company which owns potash mines of its own but has rather larger interests in the production of chemicals from crude potash, reports for 1942 that it has bought a saline plant in Lorraine and an electrolytic plant in Alsace. The saline plant is converted. The mines are said to have worked without trouble, and good progress is reported in development work. Demands from customers were extensive. Funds for the new investments were taken from reserves.

In the fertiliser year 1943/44 (June-May) 60 per cent. of the 1940/41 fertiliser tonnage is to be distributed among German farmers. Actually, the total allocations will be rather less than this, because quantities distributed under permit vouchers in 1940/41 are left out of account. It is stated that in exceptional cases farmers may apply for larger quantities of chemical fertilisers than are due to them under this arrangement.

The new Upper Silesian zinc combine reports that production reached a record in 1942. A satisfactory financial result was achieved thanks to the production subsidy and the favourable effect of the Hermann Goering works taken over on January 1, 1942. Operations proceeded normally in accordance with instructions from the control offices.

International standards for plastics are to be specified by an association of the manufacturers of plastics in Germany, France, and Italy, which has its domicile in France. The organisation, which was formed only recently, is said to have completed its work in some sectors. It aims at standardised definitions for plastic raw materials and plastic products. Standard tests to be applied all over Europe, and unified assessment methods and types are to be fixed by the association.

Austria under the Nazis

Vital Chemical and Metal Industries

AUSTRIA has become a second " Ruhrgebiet " of the Great German Reich, at present even more important in some respects than the original Ruhr in Western Germany. It is not easy to describe precisely and completely the developments since the compulsory *Anschluss,* because, besides the statistical black-out which obscures all details of German economic life, the material which would normally be obtainable from newspapers and technical journals is lacking. The *Oesterrichische Chemiker Zeitung,* once published by Julius Springer's Verlag, has ceased to exist, the old and famous Austrian Patent Office has disappeared, and many Austrian scientists and industrialists have left their country for racial or political reasons.

Right: The Styrian Erzberg, Austrian inexhaustible iron-ore reserve.

Left: In the Donawitz blast furnaces the Styrian iron-ore is smelted.

But it is known that Austria has undergone an enormous industrialisation, especially in the metallurgical and to some extent in the chemical line. The iron and steel industry is chiefly concentrated in the Alpine Montan Gesellschaft, which approaches the Ruhr plants in equipment and in importance for war purposes. It is by far the largest industrial enterprise in Austria, and now belongs to the Hermann-Göring concern. It possesses one of the largest iron ore deposits on the continent, the apparently inexhaustible Styrian Erzberg (" ore-mountain "), the Hüttenberger Erzberg in Carinthia, rich lignite mines at Fohnsdorf, Seegraben and Köflack, magnesite mines at Wald, and quartz mines at Krieglach. Roasting furnaces, working on the Apold-Fleissner process, accomplish 30-35 times as much as formerly with only one-fifth of the coal consumption. The coal-drying plants, on the Fleissner system, yield from brown coal a dry fuel with a heating capacity of 8640 to 9180 B.Th.U. per lb., and thus provide a substitute for foreign coal.

The new Hermann-Göring Werke in Linz on the Danube, a gigantic iron and steel plant, were intended to use low-grade iron ores but had had no great success in this direction, and had to fall back on Alpine ores. They employ about 60,000 workers. Nearly all the Austrian iron and non-ferrous metal industries have been merged with the

Herman-Göring firm and with other German concerns on a basis which can only be described as completely shameless. It was contrived by blackmail purchases of old firms at ridiculously low prices and often by downright robbery.

Whereas Austria's largest factories before the *Anschluss* did not employ more than 7000 workers (Steyr Werke) there are now in existence such establishments as the Ostmark Aircraft Works (60,000 workers) and the St. Pölten Glanzstoff Werke (12,000 artificial-silk workers) and many others for which no exact figures are available. The whole 40 miles between Vienna and Wiener-Neustadt are now an enormous industrial plant—another Ruhr in Austria. The non-ferrous metal production is restricted to lead (Bleiberger Bergwerks Union, Carinthia and Liesing), copper on a small scale (Brixlegg and Mitterberg), aluminium, and magnesium, while zinc ores are mined but not worked off.

Inorganic Chemicals

The chemical industry of Austria was always and is still chiefly inorganic. The greatest chemical works, the Pulverfabriken Skoda-Wetzler A.-G. (Moosbierbaum) and the Wagemann-Seybel A.-G. (Liesing), now the property of I. G. Farbenindustrie and much enlarged, produce heavy chemicals, inorganic acids and salts, gunpowder, explosives, fertilisers, fullers' earth, etc. The A.-G. für Chemische Industrie, Rannersdorf (sulphuric acid, glue and other adhesives, artificial fertilisers, etc) has been absorbed by the Scheidemandel concern. But they are no substitute for the German works destroyed by the R.A.F., *e.g.*, the I. G. Farben works in Berlin, Elberfeld, Höchst, Ludwigshafen, Frankfurt a/M., etc., because the Austrian works produce neither dyestuffs, pharmaceuticals, nor photographic chemicals. Furthermore, Austria has no synthetic oil plants on the Bergius system, no synthetic rubber plants, no synthetic ammonia plants utilising the Haber process. The elimination of these German works in the battle of the Ruhr is therefore irreparable. The two Austrian plastics works, producing Alkalit and Polloplas, were taken over by the German Sprengstoff Werke A.-G.

A comparatively new or at least expanded industry which has developed under German influence is the production of light metals and their alloys, *e.g.*, of aluminium (Lend Gastein and Gmunden) and of magnesium. The annexation of Austria won for Germany magnesite deposits which, after those of Russia and Manchuria, take the third place in world production. Three companies formerly shared these mines, the Veitscher Magnesitwerke A.-G., the Magnesite A.-G., Radenthein, and the Alpenländische Bergbau G.m.b.H., the latter a subsidiary of the Friedrich Krupp A.-G., Essen. Now the Göring concern and I. G. Farben control and exploit the whole magnesite and magnesium production of Austria, which is managed by their subsidiaries.

According to a report of the Petroleum Press Service, the Zistersdorf Petroleum Works of Austria are now supposed to produce 750,000 tons of oil a year, compared with a pre-war production of about 50,000; this seems exaggerated, although it is doubtless true that the Austrian petroleum industry has largely increased. Another highly developed industry is the production of cellulose (Zellstoff), *e.g.*, at the Lenzinger works, modernised and much enlarged by the former owners, the international firm Bunzl & Biach, the Leykam-Josefsthal A.-G., the Steyrermühl A.-G., and the Kellner-Partington Co., Hallein, now all in German hands. All these are only glimpses of the development of some of Austria's industries in war-time.

A striking illustration of the increased industrial importance of Austria in the German war effort is afforded by some recently-published figures of investments. In 1941, 49 million RM. were newly invested in industrial enterprises, of which 6 million RM. were placed in Austria. In 1942 out of 70 million RM. invested 59 million went to Austria, and the speed of this development is still increasing. As the biggest and wealthiest financial undertakings have also been taken over by German trusts, the German-controlled industries can easily get any credit they require for a further extension of their works. Furthermore, about three million Germans are estimated to be working in Austria and large numbers of foreign workers and prisoners of war have been sent there. Practically the whole of Austria's economic life has passed into the hands of the Germans who, as always, have made themselves thoroughly unpopular. It may be assumed that an Allied victory would be welcome to the true Austrians, who might thereby regain their own livelihood and a renewal of independent economic existence.

SOAP WORKS ACCIDENT

At Falkirk Sheriff Court last month the Scottish Co-operative Wholesale Society, Ltd., 95 Morrison Street, Glasgow, pleaded guilty to a charge, brought by H.M. Inspector of Factories, of having, on March 26 at their soap-making premises in Grangemouth, operated an automatic soap-stamping machine, of which the stamp and die had not been securely fenced, contrary to the Factories Act. It was stated that the machine was operated by a boy of 14 years and a girl of 16 years; the latter had been injured. A fine of £6 was imposed.

Personal Notes

MR. STUART PEXTON, Ph.D., a research chemist of The Gas Light and Coke Company, has been awarded the D.Sc. degree of Leeds University.

PROFESSOR R. V. SOUTHWELL, F.R.S., rector of Imperial College, and DR. H. LOWERY, principal of Essex Technical College, represent science on Lord Hankey's post-war professional appointments committee.

The Franklin medal and honorary membership of the Franklin Institute, Philadelphia, have been awarded to DR. HAROLD C. UREY, professor of chemistry in Columbia University, for his discovery of heavy hydrogen, which has proved of immense importance to research in chemistry, physics and biology.

MR. J. C. W. STEAD, B.Sc., has been appointed manager of the Wellcome Chemical Works at Dartford as from October 1. He has been production manager with Cooper McDougall & Robertson, Ltd., since 1934. Before that he was for six years with Crosse & Blackwell Ltd., in Belgium, the Argentine, and Canada.

New associates of the Institution of Rubber Industry include MR. C. W. BUCKLES, B.Sc., A.I.C., chief chemist, Pirelli General Cable Works; MR. J. H. SIMMS, I.C.I. Rubber Service Laboratories; MR. HAROLD TAYLOR, head of latex department, I.C.I. Dyestuffs, Ltd., and MR. C. W. THOMPSON, assistant chemist, United Ebonite & Lorival, Ltd.

Obituary

MR. DAVID MCCANDLISH, F.I.C., who has died at Kirn, Argyllshire, at the age of 68, was a native of Leeds, and was trained in the laboratory of the late Thomas Fairley, Leeds City Analyst, and at the Yorkshire College. For 30 years he was chief chemist to Joshua Tetley & Sons, Ltd., the Leeds brewers. His brother is Professor Douglas McCandlish, head of the Leather Technology Department of Leeds University.

Horticultural Chemistry

Tear Gas in Soil Treatment

THE annual report for 1942 of the John Innes Horticultural Institution contains several points of interest to chemists. It is stated that during the year comparative studies were made of soil sterilisation by means of tear gas (chlorpicrin) and phenolic compounds. In comparison with steam sterilisation, which is 100 per cent. effective in killing weeds, chlorpicrin eliminated 94 per cent. Two proprietary sterilisers, both using phenolic compounds, gave figures of 88 and 73 per cent. elimination.

The Institution received many inquiries for a substitute for sulphate of potash used in the John Innes Base Fertiliser, a widely used horticultural manure. Tests showed that 2 oz. of muriate of potash is a very fair substitute for 3 oz. of sulphate of potash.

Experiments with plant hormones have been conducted. α-Naphthalene acetamide, used in America and elsewhere to prevent the "June-drop" of apples (whereby the fruits set but soon drop off), has been tried both in aqueous and in lanolin solution, and it was found that the hormone led to the production of a number of seedless fruits. It is also remarked in the report that treatment with this compound may prove to be a useful aid to increase the fruitfulness of such poor cropping fruit varieties as the pear Doyenne du Comice. Another line of investigation, in which the hormone applied was α-indole acetic acid, leads to the conclusion that the phenomenon known as "roguing" of tomatoes is due to a maladjustment of growth hormones.

Future of U.S. Coal Research

Mr. Ickes's Views

IN a survey of the American coal industry's future, Mr. Harold Ickes, Secretary of the Interior and U.S. Petroleum and Solid Fuels Co-ordinator, recently described the important part that coal will have to play in meeting the declining number of petroleum deposits discovered in recent years. The first step, says Mr. Ickes, is the conservation of known petroleum resources, and he is thus seeking authority from Congress to build and operate demonstration-type, industrial-scale, coal-hydrogenation pilot plants. The annual production rate in Germany he estimates at 5 million metric tons or more, and he declares that I.C.I. is operating a "direct hydrogenation plant with a capacity of 3500 barrels daily." In the United States, Mr. Ickes believes that private enterprise cannot be expected to enter the field at this stage, and that far more rapid progress can be made with Federal finance. Many technical troubles, he believes, may be solved "by the simple expedient of borrowing engineers from I.C.I."

Mr. Ickes also stresses the coming dependence of synthetic rubber and plastics manufacturers upon coal. On the continuance of synthetic rubber production after the war he says, "This is reasonably sure to remain as one of our large post-war industries. Aside from the question of cost, it is inconceivable that the U.S. should expose itself to the mercies of a foreign source of rubber which might be cut off."

General News—From Week to Week

The Library of the Chemical Society will be entirely closed for cleaning from August 2 to August 7, inclusive.

Some 5000 tons of tin, 30,000 tons of rubber and 25,000 tons of edible oils were intercepted by the British blockade last year, as well as smaller quantities of tungsten and quinine. These figures were given by Mr. Dingle Foot last week when the work of the Ministry of Economic Warfare was debated in the House.

British cattle are being de-horned by means of a process in which caustic potash kills the growing tissue of the horn bud. The technique, which the Minister of Agriculture and the National Farmers' Union advocate, results in less trough room being required by each beast and enables more animals to be kept in the yards.

British scientists are to raise £3500 to equip the laboratory of the new Stalingrad hospital. This pledge was announced on Sunday night by the president of the Royal College of Surgeons, Sir Alfred Webb-Johnson, at the "Science for Victory" meeting in London arranged by the Association of Scientific Workers to synchronise with a similar meeting held in Moscow.

A new synthetic insecticide, developed in British laboratories, is proving more efficient against the turnip flea beetle than derris. It appears to act partly as a fumigant and partly as a stomach poison, killing every pest it contacts in about half an hour. The chemical composition of this fine grey powder; which has an earthy smell, is being kept secret.

The index figure for wholesale prices, issued by the Board of Trade, remains constant for iron and steel (182.8) and for non-ferrous metals (126.0). The figure for chemicals and oils, however, has risen by 1 per cent. from 144.0 to 145.5 (the largest group rise for the month). This is wholly attributable to the 17 per cent. increase in the price of refined groundnut oil, which came into effect on May 30.

The Chemical Engineering Group of the S.C.I. has produced four new Data Sheets (Nos. 11, 11a, 11b, and 11c), showing properties of mixtures of H_2SO_4-HNO_3-H_2O. The diagrams (which are admirably clear) are drawn up by Dr. G. E Stephenson, A.M.I.Chem.E., A.I.C., and supplied by the Thermal Syndicate, Ltd. The set is obtainable from the Group (56 Victoria Street, London, S.W.1), price 5s.

Foreign News

A leather substitute made by impregnating close-woven cotton fabric with a plastic is reported from America.

A soya-bean plastic is now being used for the production of laminated board, according to Dr. G. H. Brother, of the U.S. Regional Soybean Industrial Products Laboratory.

A research committee is exploring the possibilities of establishing an industry for the manufacture of ceramics, bricks, tiles, and pottery in the East African territories.

Glass is now being used instead of steel in precision gauges to save annually 250 tons of tool steel in American government arsenals alone; new developments have made glass less fragile.

Coal tar is reserved in Canada for war industries. The Department of Munitions and Supply has banned its use for fuel and in road-making and, except in British Columbia, a permit is now needed when handling tar at a rate exceeding 40 gallons a month.

Attempts to manufacture the plastic styled "Cafelite" from surplus coffee have not been entirely successful, according to the National Coffee Department of Brazil. Experiments in this connection are to be continued.

Plans are under way for the extensive development of deep-sand potential natural gas reserves near Bradford (Penna.), U.S.A. including drilling 4500 ft. wells, and installation of pipe lines, booster stations, and other equipment.

Bauxite deposits in Croatia are being developed by the Nazis. One of the factories being built near the deposits will have a capacity of 100,000 tons of ore a year. The programme of exploitation includes the erection of hydroelectric plants to provide the necessary power.

Distribution of rotenone insecticides for agricultural purposes is now controlled by the U.S. War Food Administrator. The War Production Board continues to control the delivery of rotenone, both crude and processed, to the Army, Navy and other government agencies, as well as its export.

The Italian synthetic rubber concern, Società Industria Gomma Sintetica, is scheduled to receive 425 million lire credits for investments during the next five years to extend its plant. Technical results so far obtained are said to justify larger investments in plan.

Official approbation of an allotment of $2,655,000 for construction of a pilot plant for alumina at Holly Hill, South Carolina. U.S.A., has been granted to the American Nepheline Company, New York. The plant will have a daily capacity of 40 tons of aluminium; clay and limestone will be obtained locally.

The U.S. Government's magnesium plant at Las Vegas, Nevada, which cost £32,000,000, went into full production on Tuesday. It was stated that its output of this vital war material would be three and half times that of the present world total.

Shortage of calcium metal has led to a Preference Order in the U.S.A. for "any product containing the element calcium not in chemical combination, and in which any metallic constituents other than calcium do not constitute more than 15 per cent. by weight."

Aerial photographs showing the damage done by the 2000 tons of bombs dropped on Dortmund on May 23, reveal that the Hoesch Fischer-Tropsch synthetic oil plant has been put out of action. The benzol factory of Harpener Bergbau A.G. was destroyed, and the ammonia plant damaged.

U.S. production of fluorspar was 8 per cent. higher last year than in 1941—337,000 short tons, compared with 313,000. The Illinois-Kentucky district contributed 79 per cent. of the total. Steel mills were the principal consumers, taking 63 per cent., but much larger quantities were used to make hydrofluoric acid than in 1941.

Standard Oil recently offered to transfer permanently to the U.S. Government the patent rights in Buna-S, the synthetic rubber now being produced in enormous quantities in the States. The offer has been accepted. The company believes that it is the first time that any company has offered a Government the right to licence important patents, royalty-free and for ever, to everyone, even to its competitors.

Forthcoming Events

A meeting of the **Royal Institute of Chemistry** (Birmingham and Midlands section) will be held in the Latin Theatre, Birmingham University, on **July 21,** when Mr. S. B. Tallentyre will speak on "Essential Oils" at 6.30 p.m.

The celebration of the centenary of **Rothamsted Experimental Station** will be held on **July 21.** Visitors will be shown the laboratories, field experiments and the hundredth wheat crop on Broadbalk Field. The Minister of Agriculture, Mr. R. S. Hudson, will be present. The proceedings open at 10.45 a.m.

A meeting of the **Institute of Fuel** will be held in the James Watt Memorial Institute, Great Charles Street, Birmingham, at 2.30 p.m., on **July 21,** when a paper, "Radiant Heat for Industrial Processes 'Infra-red' by Gas," will be presented by L. W. Andrew, B.Sc., and E. A. C. Chamberlain, Ph.D., of The Gas Light and Coke Co.

The 80th **British Pharmaceutical Conference** will be held on **July 29,** from 9.30 a.m. to 6.30 p.m., at the Waldorf Hotel, Aldwych, London, W.C.2.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

HARRISON'S LIMEWORKS, LTD., Penrith. (M., 17/7/43.) June 23, 1st debenture to Martins Bank, Ltd., securing all moneys due or to become due to the Bank; general charge. *Nil. May 14, 1940.

HYDRAN PRODUCTS, LTD., Staines, engineers. (M., 17/7/43.) June 19, £55,000 debenture to Branch Nominees, Ltd., general charge (subject, etc.). *£35,000. July 23, 1942.

RATBANE, LTD., London, W, manufacturers of vermin exterminators. (M., 17/7/43.) June 23, £500 debentures; general charge.

Satisfaction

HARRISON'S LIMEWORKS, LTD., Penrith. (M.S., 17/7/43.) Satisfaction June 23, of mortgage registered October 10, 1928.

County Court Judgment

JENKINS, CYRIL, Sea-view, Penclawdd, Gorseinon, chemist in steelworks. (C.C.J., 17/7/43.) £11 15s. 6d. May 26.

Company Winding-up Voluntarily

COAL CONVERSION, LTD. (C.W.U.V., 17/7/43.) By special resolution passed June 29.

Declarations of Solvency

POLARIZATION PRODUCTS, LTD. (formerly Polaroid Products, Ltd., & Polarizers, Ltd.), London, E.C. Declaration of solvency filed June 22.

SAXON CHEMICAL CO., LTD., Radcliffe. Declaration of solvency filed June 25.

Company News

The Standard Chemical Co. announce a final dividend of $1.25 per share (same).

Super Oil Seals and Gaskets, Ltd., announce an interim dividend of 15 per cent. (same).

The Midland Bank, Ltd., is paying an interim dividend of 8 per cent., less tax (same), for the half-year ended June 30.

The Yorkshire Dyeware and Chemical Co., Ltd., are paying a final dividend of 10 per cent., making 15 per cent., less tax, for the year ended March 31 (12½ per cent.).

Lansil, Ltd., for the year to March 31 last, are making a first dividend payment of 15 per cent. on the deferred capital. The ordinary dividend is 8.3924 per cent., against 6 per cent. last year.

British Plaster Board, Ltd., report a net profit, for the year to March 31 last, of £252,633 (£359,827). The dividend, as already announced, has been maintained, and the carry-forward is raised from £265,072 to £310,626.

Beechams Pills, Ltd., announce a record trading profit of £1,269,334 (£1,175,215), and a net profit of £452,457 (£396,381). The total dividend on deferred stock is 30 per cent. (28½ per cent.). Of the subsidiary companies, **Eno Proprietaries** are paying an ordinary dividend of 19.4 per cent. (18 per cent.); **Veno Drug** report a dividend of 1s. 11d. (1s. 9d.) on deferred shares; **Yeast-Vite** announce an ordinary dividend of 75 per cent. (82½ per cent.); **A. F. Sherley** are paying no deferred dividend (12 per cent.); **Macleans** 27 per cent. (30 per cent.); and **Prichard and Constance** 60 per cent. (24 per cent.).

New Companies Registered

Blue Crown Products, Ltd. (381,516).—Private company. Capital: £100 in 100 shares of £1 each. Manufacturers of and dealers in chemicals, drugs, disinfectants, colours, oils, etc. Directors: P. Aelion; H. A. Mumford. Registered office: 110 Cannon Street, E.C.4.

Chemical and Allied Stocks and Shares

UNDER the lead of British Funds, which recorded further gains compared with a week ago, firm conditions have ruled in Stock Exchange markets. Although sentiment was good in response to the latest war developments there was no marked improvement in the volume of business. Imperial Chemical showed activity, and at 39s. 3d. were maintained on balance, while Lever & Unilever at 33s. 9d. more than held their recent improvement. The shares of the last-named company are among those favoured in the market on the assumption that higher dividends may rule after the war. Turner & Newall, which are also included in this category, held their recent rise to 77s. 6d.; as in many other instances, current yields are small, but there is general willingness to take more than a short view and hold for a lengthy period.

The units of the Distillers Co. at 83s. 3d. were firm on consideration of the annual statement, which tended to draw attention to the widespread interests and activities with which the company is connected. Its activities in the chemical and plastics fields, coupled with the ever-increasing demand for research, have been fully maintained; investments connected with plastics are extensive and increasing, but it is added that it is somewhat early to say how they will develop. Lewis Berger remained firm under the influence of plastics developments, and maintained their rise to 88s. 9d. On the other hand, Thomas De La Rue at £6½ xd. lost part of their recent advance. British Industrial Plastics 2s. shares have been maintained at 5s. 10½d., and Lacrinoid Products were 4s. 6d. Elsewhere, Allied Ironfounders were 47s. 3d. "ex" the dividend, while Barry & Staines recorded a further small rally to 40s. 9d. xd. British Match were at the slightly higher level of 39s. 6d., while Borax Consolidated were again 33s. 6d., and British Aluminium 48s. At 74s. 6d. British Oxygen showed a small gain on balance, and Dunlop Rubber (37s.) were virtually the same as a week ago. British Plaster Board 5s. shares eased to 26s. 9d., but Associated Cement at 57s. 6d. were 6d. above the level ruling a week ago. Shares of rayon manufacturers have been active at higher prices under the influence of the increased dividend on Lansil ordinary. The latter rose to 27s., while Courtaulds were 53s. 3d., and British Celanese 22s. 6d., compared with 21s. 9d. a week ago.

Greeff Chemicals 5s. ordinary have changed hands at 7s. at the time of writing. Monsanto Chemicals 5½ per cent. preference were again quoted at 22s. 6d. B. Laporte kept at 78s., and Burt Boulton around 19s., while British Drug Houses were 20s., Lawes Chemical 12s., and Cellon 22s. 6d. In some instances, however, quotations were not tested by many dealings owing to the firmness with which shares are held. Yield considerations and market talk of the possibility of a higher dividend governed sentiment in regard to Sangers ordinary shares, which compared with a week ago have risen from 20s. 4½d. to 23s. 1½d. Boots Drug 5s. ordinary were well maintained at 40s. 6d. Record sales were again reported by the last-named company, but last year this was reflected only to a moderate extent in net profits owing the weight of taxation. Beechams Pills deferred were higher at 15s., following publication of the financial results.

Small declines were shown among a number of iron and steel shares. Babcock & Wilcox were 47s., compared with 47s. 7½d. a week ago, Dorman Long 26s. 6d. compared with 26s. 7½d., and United Steel 25s. compared with 25s. 6d. On the other hand, Tube Investments were slightly better at

91s., while Richard Thomas 6s. 8d. ordinary were firm at 10s. on talk of an improved dividend, and Stewarts & Lloyds unchanged on balance at 50s. 4½d. Imperial Smelting were maintained at 14s. 1½d., and at 15s. 6d. General Refractories were little changed. Elsewhere, Leeds Fireclay ordinary and preference changed hands at higher levels, while British Glues & Chemicals 4s. ordinary were the same as a week ago. Burmah Oil, Anglo-Iranian, and other oil shares were less active than last week.

British Chemical Prices

Market Reports

FROM the point of view of contract supplies fairly satisfactory trading conditions have been reported from the general chemical market in London this week, while fresh inquiry has been on a moderate scale. Prices generally remain firm and there is a strong undertone throughout. Among the soda compounds, industrial refined nitrate of soda is being taken up in fair quantities and good deliveries of Glauber salt and salt cake are reported. There is no change with regard to caustic soda, which is meeting with a steady inquiry. Quotations for bicarbonate of soda and soda ash are well held and a moderate business is reported in hyposulphite of soda and acetate of soda. In the potash section supplies of caustic potash are being steadily absorbed, while the pressure for deliveries of permanganate of potash is maintained. Yellow prussiate of potash is rather widely quoted and offers continue scarce. There is a fair demand for acid phosphate of potash at firm rates. There is no change of any consequence in the coal-tar products market this week. A fair trade is reported in pitch, while crude and refined tar are active sections. Cresylic and carbolic acid are in steady demand and a fair business is reported for the xylols.

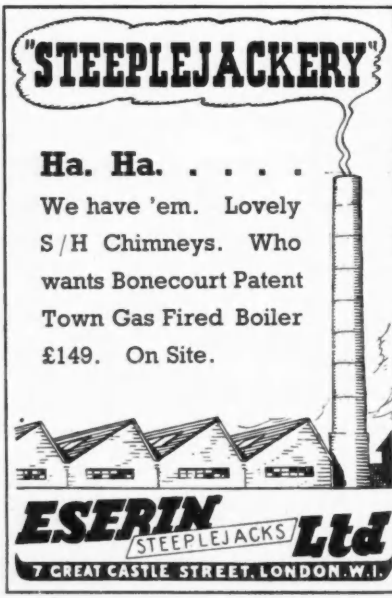
MANCHESTER.—New business in the Manchester chemical market during the past week has been of moderate extent, industrial holidays in Lancashire and the West Riding of Yorkshire having their effect on this, as well as to some extent on the movements of supplies under contract. On the whole, however, deliveries are on a fair scale. Caustic soda, soda ash, bicarbonate and most of the other soda compounds are moving into consumption steadily, chiefly under contracts, while the demand for the ammonia and magnesia products has been satisfactory. The scarce potash chemicals continue to find a ready outlet. With regard to the tar products, both the light and the heavy materials are mostly in good demand.

GLASGOW.—In the Scottish heavy chemical trade business for the home trade was quiet during the past week owing to the annual holidays. Export trade is still rather restricted. Prices continue to be very firm.

Price Changes

Copper Oxide.—Black, powdered, about £100 per ton.

Tin Oxide.—Snow-white, controlled material, about 330s. per cwt.; free (nominal), 400s.-500s. per cwt.



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Vertical CHANGE PAN MIXER, by Barker & Aspey; removable mild steel pan 18 in. dia. by 14 in. deep, carried on geared turntable and driven from f. & l. pulleys; hand-operated rise and fall mechanism; complete with two spare pans.

Horizontal Hexagonal Shaped POWDER MIXER by Pratchitt Bros.; drum 5 ft. 0 in. long by 3 ft. 4 in. wide mounted at an angle of 45 deg. on horiz. shaft, driven through worm gearing from f. & l. pulleys; feed and discharge openings.

Horizontal Mild Steel STEAM JACKETED MIXER, stationary drum type, 3 ft. 9 in. dia. by 8 ft. 0 in. long; horiz. glanded agitating shaft, fitted with heavy mixing blades and driven by means of worm gearing from f. & l. pulleys; drum mounted on cast iron cradle and arranged with end feed and discharge openings.

Horizontal Werner Pfleiderer MIXER by Baker Perkins; unjacketed tilting pan 2 ft. 6 in. by 2 ft. 6 in. by 1 ft. 8 in. deep, fitted with double "Z" blades and driven through gearing from f. & l. pulleys and arranged with reversing mechanism. counter-balanced hinged cover, interlocked with driving shaft.

Horizontal PUG MIXER by Brinjes & Goodwin; "U" shaped pan 2 ft. 0 in. long by 2 ft. 0 in. wide by 2 ft. 3 in. deep; horiz. agitating shaft fitted with finger type blades and driven through gearing from f. & l. pulleys; pan arranged with ratchet operated door outlet and hinged cover.

Horizontal Mild Steel TILTING MIXER by Followes & Bate; "U" shaped pan 1 ft. 10 in. by 1 ft. 10 in. by 2 ft. 6 in. deep, fitted with twin sigma blades, driven through gearing from f. & l. pulleys; hand-operated tilting mechanism.

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